Appendix A – GPRA06 Benefits Estimates: MARKAL and NEMS Model Baseline Cases

MARKAL Baseline Case Assumptions and Projections

Economic and Demographic Assumptions

The reference case projection used to evaluate the impact of the EERE portfolio was benchmarked to EIA's *2004 Annual Energy Outlook* (AEO) for the period between 2000 and 2025. To the extent possible, the same input data and assumptions were used in MARKAL as were used to generate the AEO reference case. For example, the macroeconomic projections for GDP, housing stock, commercial square footage, industrial output, and vehicle miles traveled were taken from the AEO. At the sector level, both supply-side and demand-side technologies were characterized to reflect the AEO assumptions, in cases where the representation of technologies is similar between MARKAL and the National Energy Modeling System (NEMS). The resulting projections track closely with the AEO at the aggregate level, although they do not match exactly at the end-use level. For the period after 2025, various sources were drawn upon to compile a set of economic and technical assumptions. The primary economic drivers of GDP and population were based on the real GDP growth rate from the Congressional Budget Office's *Long-Term Budget Outlook* and population growth rates from the Social Security Administration's *2003 Annual Report* to the Board of Trustees.

In the reference case, GDP is projected to increase at an average annual rate of 2.8 percent 2000 to 2025, and then slow to an average annual rate of 2.2 percent from 2025 to 2050. The population growth rate is projected to decline from an average annual rate of 0.9 percent between 2000 and 2025 to 0.5 percent from 2025 to 2050. The reference case macroeconomic assumptions are shown in **Table 1.**

Table 1. Reference Case Macroeconomic and Demographic Assumptions

												Annual Growth Rates		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
GDP (Bill. 2002$)	$10,163	$11,502	$13,479	$15,592	$17,900	$20,478	$23,169	$26,023	$29,014	$32,021	$35,267	2.8%	2.2%	2.5%
Population (Million)	275.7	296.8	309.3	321.9	334.6	347.5	359.4	370.4	378.8	384.9	390.4	0.9%	0.5%	0.7%
Total Households (Million)	105.2	113.7	119.8	126.1	132.0	137.8	143.8	148.1	151.5	153.9	156.2	1.1%	0.5%	0.8%
Commercial Floorspace (Bill. sq ft)	68.5	77.6	83.8	89.9	95.9	101.8	108.0	114.1	120.2	126.0	131.9	1.6%	1.0%	1.3%
Industrial Production (2000=100)	100	99	113	128	146	166	186	207	229	250	274	2.0%	2.0%	2.0%
Light Duty Vehicle Miles Traveled (Bill. VMT)	2,355	2,709	3,041	3,409	3,768	4,173	4,507	4,829	5,086	5,277	5,455	2.3%	1.1%	1.7%

Assumptions on Energy Prices

Table 2 shows projected energy prices for the reference case. Natural gas prices are projected to drop between 2000 and 2005, and then increase at nearly 1 percent per year from 2005 to 2025 before increasing amounts of arctic gas and LNG imports limit the average annual increase to 1.3 percent from 2025 to 2050. Crude oil prices are also projected to drop between 2000 and 2005, increase at average annual rates of 0.8 percent between 2005 and 2025, and 0.8 percent per year thereafter.

Average mine mouth coal prices are projected to continue to decline by about 0.2 percent a year between 2000 and 2025, due to increasing productivity gains and a continued shift to less labor intensive Western coal production. However, coal prices are projected to increase at an average rate of 1 percent per year after 2025, due to increased demands, gradually increasing mine depths and a saturation of labor productivity gains.

Table 2. Reference Case Energy Prices

												Annual Growth Rates		
2002 $s	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
World Oil Price ($/bbl)	$28.61	$22.95	$24.15	$24.98	$26.25	$26.89	$28.03	$28.80	$29.94	$31.15	$32.42	-0.2%	0.8%	0.3%
Natural Gas Wellhead Price ($/Mcf)	$3.71	$3.49	$3.38	$4.30	$4.19	$4.17	$3.92	$4.36	$5.10	$5.31	$5.79	0.5%	1.3%	0.9%
Coal Minemouth Price ($/short ton)	$17.30	$17.20	$16.65	$16.27	$16.17	$16.54	$17.43	$17.88	$18.89	$19.96	$21.18	-0.2%	1.0%	0.4%
Average Wholesale Electricity Price (¢/kWh)	4.0¢	4.4¢	4.9¢	5.7¢	6.0¢	5.7¢	4.3¢	5.3¢	5.0¢	5.1¢	5.1¢	1.4%	-0.4%	0.5%

Primary Energy Consumption

As a result of slightly increasing energy prices, technology improvements, and shifts within the economy, energy demand is projected to increase more slowly than GDP. As shown in **Table 3**, total primary energy use is projected to increase at a rate of 1.3 percent per year from 2000 to 2025, and at an average annual rate of 0.4 percent between 2025 and 2050. By 2050, total primary energy consumption is projected to reach 152 quadrillion Btus (quads). Overall, the energy consumption to GDP ratio is projected to decline by 1.6 percent per year from 2000 to 2050, while total carbon emissions increase by 1.4 percent per year over the same period.

Table 3. Primary Energy Consumption, Energy Intensity and Carbon Emissions

												Annual Growth Rates		
	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050	'00-'25	25-'50	'00-'50
Petroleum	39.8	40.9	44.9	48.5	51.3	54.8	57.6	59.9	61.9	63.4	64.6	1.3%	0.7%	1.0%
Natural Gas	22.0	24.1	26.6	29.0	30.8	31.5	31.8	33.6	35.1	35.8	36.6	1.4%	0.6%	1.0%
Coal	22.4	23.5	25.4	26.5	28.3	31.3	33.5	34.3	35.1	35.6	35.9	1.3%	0.5%	0.9%
Nuclear	8.1	8.4	8.4	8.6	8.6	8.6	8.5	6.6	6.0	4.2	2.7	0.2%	-4.5%	-2.2%
Renewables	6.5	7.6	8.0	8.9	9.5	9.8	10.1	11.5	11.7	11.9	12.1	1.7%	0.9%	1.3%
Total Primary Energy	**98.8**	**104.4**	**113.3**	**121.4**	**128.6**	**136.0**	**141.5**	**145.9**	**149.8**	**151.0**	**151.8**	**1.3%**	**0.4%**	**0.9%**
Energy/GDP (Thos. Btu/ '01$ GDP)	9.8	9.1	8.4	7.8	7.2	6.6	6.1	5.6	5.2	4.7	4.3	-1.6%	-1.7%	-1.6%
Carbon Emissions (MMT)	1,594	1,678	1,840	1,965	2,089	2,236	2,346	2,435	2,512	2,562	2,600	1.4%	0.6%	1.0%

Crude oil's share of total energy consumption is projected to increase from 40 percent in 2000 to nearly 43 percent in 2050. The natural gas share is projected to grow from 22 percent to 24 percent over the same period. Coal generation is projected to increase slightly from a 23 percent share in 2000 to nearly 24 percent in 2050. Almost all existing nuclear generation capacity is assumed to retire between 2025 and 2050. However, 29 GW of new nuclear capacity is projected to be added between 2025 and 2050. The share of renewable energy is also projected to be relatively stable at between seven and eight percent throughout the projection period.

As the MARKAL reference case projection was calibrated to the *2004 Annual Energy Outlook*, the natural gas supply assumptions are more pessimistic than in the 2003 AEO. By 2050, LNG imports and Arctic gas supplies account for 38 percent of gas supply. **Figure 1** shows natural gas supplies by source for the reference case.

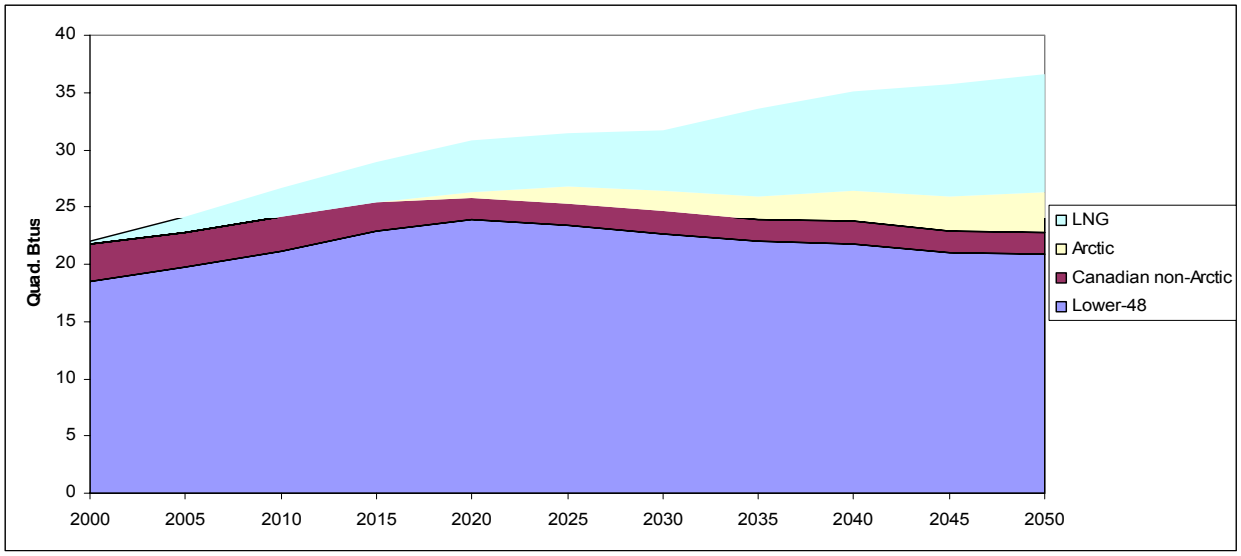
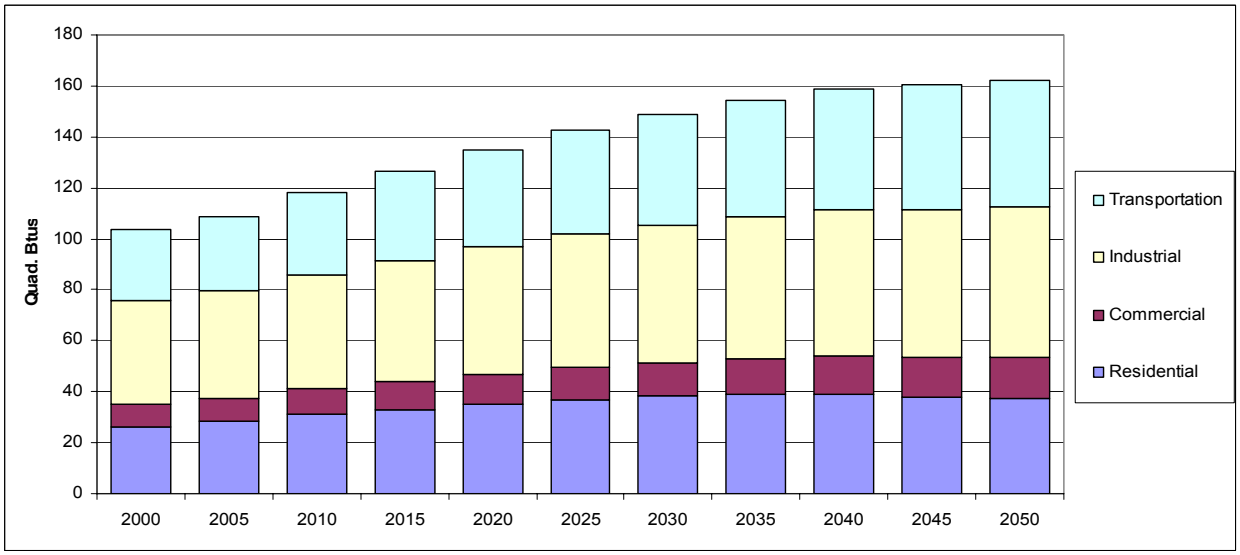


Figure 1. Reference Case Natural Gas Supply by Source

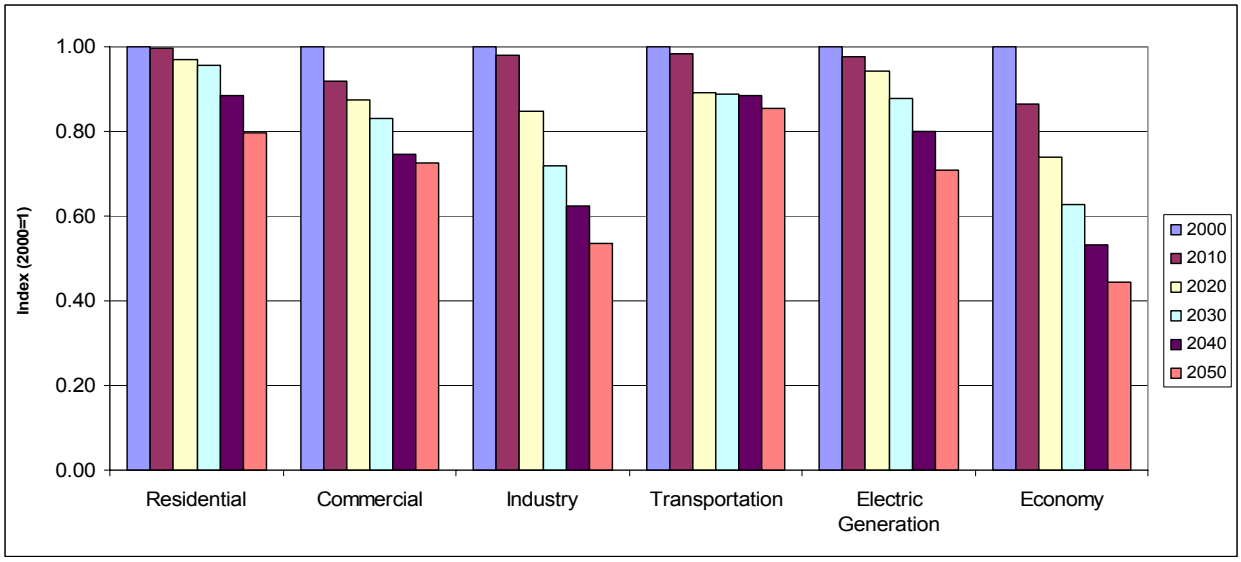
End-Use Energy Demand

The sectoral breakout of energy use, shown in **Figure 2**, demonstrates that transportation energy demand is projected to increase most rapidly, at 1.2 percent per year, from 2000 to 2050; while residential and industrial energy demand increases most slowly, at 0.7 percent per year. Commercial energy demand is projected to grow at a rate of 1.1 percent per year. The growth rates in energy consumption are a function of the opposing trends of increasing end-use energy service demand and improvements in the efficiency of technologies that satisfy this demand, as well as macroeconomic shifts toward less energy-intensive industries. This phenomenon is best illustrated by examining the energy intensity of the economy. **Figure 3** shows the relative energy intensity for different end-use and conversion sectors and the economy as a whole.



Note: consumption totals include electric generation and distribution losses

Figure 2. Energy Consumption by Sector



Note: Residential index is primary energy excluding misc. use per household; Commercial index is primary energy use excluding office equipment and misc. appliances per square foot; Industrial index is total primary energy per unit output; Transportation index is LDV primary energy per mile traveled; Electricity index is non-renewable average heat rate; and Economy index is total primary energy per unit GDP.

Figure 3. Relative Energy Intensity by Sector

As shown in **Figure 3**, our reference case projection indicates that the energy intensity of the economy (which we've defined as total primary energy consumption per $ of GDP) is projected to fall by more than half by 2050. This decrease reflects both a continued shift toward a service-based economy, as well as increases in energy technology efficiency. End-use efficiencies are projected to increase throughout the economy over the projection period as new, more efficient capital stocks are purchased to replace existing equipment and to meet new demand. The reference case technology database includes technologies that are expected to become available in the future, as well as those that are currently on the market. For example, more efficient electric heat pumps and light-duty vehicles are assumed to become available throughout the projection period. The technical and economic data associated with these technologies are derived from a variety of sources, but rely most heavily on the NEMS database.

The residential energy intensity index shows significant improvements in energy use per household. However, the residential index excludes "miscellaneous demands," the fastest growing segment of residential energy demand. The miscellaneous demand category includes electric devises such as home computers, TVs, microwave ovens, as well as devices such as gas lamps and swimming pool heaters. Because these service demands are growing faster than the sector as a whole, their energy use per household actually rises over time. Thus, the inclusion of miscellaneous demands in the calculation of residential energy intensity would obscure the efficiency gains being made in other residential service demands.

The commercial energy intensity index shows significant improvements in energy use per square foot. However, as with the residential sector, this calculation excludes the fastest growing demand categories; office equipment and miscellaneous commercial appliances. The inclusion of these demand categories would result in relatively constant commercial energy demand per square foot.

The industrial-sector efficiency index shows dramatic declines in energy intensity due to a shift from energy-intensive industries to nonenergy-intensive manufacturing, as well as improvements in process efficiency. Between 2005 and 2050, nonenergy-intensive manufacturing output is expected to grow at twice the rate as energy intensive industrial output. This shift in output exaggerates the decline in energy intensity. However, in the transportation sector, consumer preferences for more powerful engines and a continued shift from passenger cars to SUVs, limit gains in overall efficiency.

On an individual technology basis, there are several important trends in the reference case technology assumptions. Although most technologies' capital costs are assumed to remain constant at their current level in real terms, the costs of a few key technologies are projected to decline over time. These include gas combined cycle, integrated coal gasification, and renewable technologies, such as wind and PV. Most of these technologies also show improvements in their heat rates or performance (e.g. capacity factor) between 2000 and 2050.

In the power-generation sector, the efficiency of nonrenewable generation is expected to increase as older, less efficient fossil steam units retire and new high efficiency gas combined cycle and IGCC capacity is built. Electric generation by type is shown in **Figure 4**. Natural gas-fired generation is projected to increase its share of total generation from about 16 percent to 28 percent over the projection period. Coal-fired generation remains the largest source of electricity at 53 to 58 percent of total generation. Due to significant retirements of existing nuclear capacity, the share of nuclear generation falls from 21 percent to 3 percent of generation in the projection period. Renewable generation is relatively constant at about 10 percent of total generation.

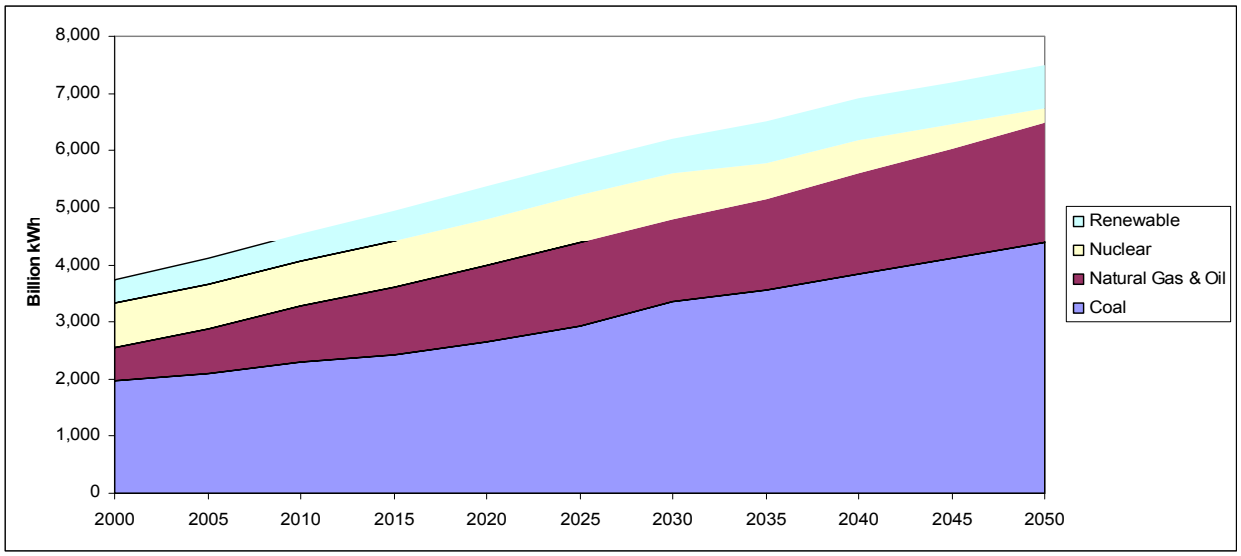


Figure 4. Electricity Generation by Type: Reference Case

While both natural gas and coal-fired generation show increased efficiency, fossil fuel use for electric generation increases by 78 percent during the projection period. Such an increase in coal and natural gas demand for power generation is dependant on the availability of these resources. However, potential reduction in supply, such as changes in the outlook in natural gas supply, would necessitate a significant change fuels used for electric generation.

NEMS Baseline Case Assumptions and Projections

Overview

The Office of Energy Efficiency and Renewable Energy (EERE) programs use integrated energy models to analyze the benefits expected from successful implementation of individual programs and the EERE portfolio as a whole. The use of integrated models provides a consistent economic framework and incorporates the interactive effects among the various programs. Feedback and interactive effects result from (1) changes in energy prices resulting from lower energy consumption, (2) the interaction between supply programs affecting the mix of generation sources and the end-use sector programs affecting the demand for electricity, and (3) additional savings from reduced energy production and delivery.

A modified version of the National Energy Modeling System (NEMS)[1] was one of the models used for this benefits analysis. NEMS is an integrated energy model of the U.S. energy system that was developed by the Energy Information Administration (EIA) for forecasting and policy analysis purposes. NEMS currently provides projection capability to the year 2025 and so is used for the midterm benefits analysis. The latest version of NEMS available at the time of the benefits analysis was used as the starting point. This is a slightly updated version from *Annual Energy Outlook 2004* (AEO2004) that was used by EIA for a set of service reports[2]. Several modifications were made to the model by EERE to enhance its ability to represent the EERE programs. The modified version of the model is referred to as NEMS-GPRA06.

GPRA 2006 Baseline

The first step in the benefits analysis process is to establish an appropriate Baseline Case. The EERE Baseline Case is a projection intended to represent the future U.S. energy system without the effect of EERE programs. This Baseline Case assures that program benefits are estimated based on the same initial forecasts for economic growth, energy prices, and levels of energy demand. It also assures that these initial assumptions are consistent with each other; e.g., that the level of electricity demand expected under the economic growth assumptions could be met at the electricity price assumed. It provides a basis for assessing how well renewable and efficiency technologies might be able to compete against future, rather than current, conventional energy technologies (e.g., more efficient central power generation). Finally, it helps assure that underlying improvements in efficiency and renewable energy are not counted as part of the benefits of the EERE programs.

The most recent Annual Energy Outlook Reference Case is used as the starting point for the developing the base case.[3] The Energy Information Administration (EIA) Annual Energy Outlook (AEO) Reference Case provides an independent representation of the likely evolution of energy markets. This forecast reflects expected changes in the demand for energy (e.g., to reflect the availability of new appliances), technology improvements that might improve the efficiency of energy use, and changes in energy resource production costs, including renewable energy.

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[1] The National Energy Modeling System: An Overview 2003, March 2003, DOE/EIA-0581(2003).

[2] Analysis of S. 1844, the Clear Skies Act of 2003; S. 843, the Clean Air Planning Act of 2003; and S. 366, the Clean Power Act of 2003" available at http://www.eia.doe.gov/oiaf/servicerpt/csa/pdf/sroiaf(2004)05.pdf. The reference case is similar to the AEO2004.

[3] As described above, the updated NEMS produces similar reference case projections as the Annual Energy Outlook 2004 with Projections to 2025, January 2004, DOE/EIA-0383 (2004). See http://www.eia.doe.gov/oiaf/archive/aeo04/pdf/0383(2004).pdf.

Current energy market policies, such as state Renewable Portfolio Standards, which facilitate the development and adoption of these technologies, are included in the Base Case. This approach ensures that EERE's benefits estimates do not include expected impacts of such policies. Neither the EIA Reference Case nor the EERE Base Case includes any changes in future energy policies.

The Baseline is constructed starting with EIA's *Annual Energy Outlook* Reference Case and then any identifiable effects of EERE programs already included are removed. For example, EIA's estimate of rooftop photovoltaic installations resulting from the Million Solar Roofs Initiative were removed for the EERE Baseline. The *AEO2004* assumption of roughly constant hydroelectric capacity over time was modified to reflect the expectation that without more environmentally benign turbine designs some reduction in hydro capacity would occur as a result of relicensing requirements. The maximum growth rates for cellulosic ethanol production were reduced by a factor of 5 because growth of this new industry is expected to be very slow without EERE program involvement.

The AEO forecast includes technology improvements in all areas of energy demand and supply and identifying what portion is due to EERE programs is extremely difficult. For GPRA06, selected technology changes were made where the AEO appeared to already incorporate the EERE program goals. Technology assumptions that were modified for the Baseline include cost and efficiency improvements in distributed combined heat and power (CHP) technologies that were assumed to be delayed without an ongoing DEER program. In addition, the two composite distributed generation technologies in the electricity generation sector were modified to reflect baseline values for gas turbines, microturbines, and gas engines. The *AEO2004* includes a significant improvement in geothermal generation technology over time, similar to the program goals. To reflect might what might occur without continued R&D funding, analysts reduced the cost reduction by half for the GPRA Baseline.

There are a few EERE technologies that are either not represented in the *AEO2004* Reference Case or their improvement is less than anticipated by the program in the absence of EERE programs. These technology assumptions were also modified for the GPRA06 Baseline. In commercial lighting, an advanced electrodeless fluorescent technology was replaced with a baseline projection of solid-state lighting characteristics. The efficiency of absorption cooling in commercial buildings was assumed to increase slightly, rather than remain constant over time. Offshore wind technology characteristics were added, and the onshore wind characteristics were modified. The onshore capital costs were increased slightly. More importantly the capacity factors for each wind class were assumed to be higher than in the AEO2004, although lower than the program goals.

A few other modifications were made to reflect EERE program assumptions or updated information about energy markets. These changes affect both the Baseline and the Benefits Cases. The size of typical PV systems was increased to 4 kW in residential and 100 kW in commercial buildings to reflect recent PV installation experience and trends. The maximum market for PV systems was increased from 30 percent to 55 percent in the commercial sector and to 60 percent for residential PVs. Similarly, the maximum market share for gas-fired distributed generation technologies was increased from 30 percent to 50 percent in the commercial sector. California PV credits were incorporated in the Pacific region. Solar water heat was added to the

slate of technologies for new homes, and the share of the replacement market in which it can compete was increased from 20 percent to 50 percent. The conversion efficiency of cellulosic ethanol was reduced because EIA's assumption appeared too optimistic.

Table 4. Summary of Baseline Changes from the AEO2004

	AEO2004	Preliminary GPRA06 Baseline Case
Representation of EERE Technology Characteristics		
Million Solar Roofs	0.4 GW installed 2005 to 2025	Removed
Photovoltaic system costs	Significant improvement	Slower rate of improvement
Hydroelectric capacity	Roughly constant hydro capacity and generation	2.2 GW reduction for 2010 to 2025
Cellulosic ethanol production	0.6 billion gallons annually by 2025	0.12 billion gallons annually by 2025
DG technology improvement	Significant improvement	Slower rate of improvement
Commercial absorption cooling efficiency	Constant over time	Increase 20 percent by 2020
Wind	30 to 44 percent capacity factors depending on wind class and year	34 to 50 percent capacity factors depending on wind class and year
Geothermal	Significant improvement	Half the rate of improvement
Energy Market Updates		
PV system size	2 kW residential, 25 kW commercial	4 kW residential, 100 kW commercial
PV maximum market share	30 percent for both residential and commercial	60 percent for residential and 55 percent for commercial
CHP commercial building maximum share	30 percent	50 percent
Commercial absorption cooling	Included in only 5 building types	Included in all 11 building types
California PV subsidy	Not included	Included for residential systems
Solar water heat	Maximum 20 percent replacement market	New and up to 50 percent replacement market
Cellulosic conversion efficiency	90 to 103 gallons of ethanol per dry ton of biomass	82 to 101 gallons of ethanol per dry ton of biomass
Structural Changes		
Wind module	One capital cost and resource multiplier for all wind classes	Capital costs and resource multipliers by wind classes
	No offshore wind technology	Offshore wind
Commercial shell efficiency	Index	Technology representation
Commercial DG algorithms		Market share and stock accounting modified

In a few cases, structural changes were made to improve the model's representation of markets important to EERE technologies. The wind module was modified, so that each of the three wind classes is treated more discretely with separate capital costs and resource multipliers. Offshore wind was added as another technology option with resources available in the coastal regions and the regions around the Great Lakes. The shell indices in the commercial module were replaced with a technology choice algorithm necessary for later representation of EERE shell technologies. In addition, alterations to the distributed generation algorithm in the building

modules were made to reflect the DEER program's market adoption data, to account for buildings that have already installed a DG technology in prior years, and to allow greater than an annual 0.5 percent adoption in existing buildings. Absorption cooling was allowed to compete in all commercial building types, rather than only a subset as in the AEO2004.

A summary of these modifications is provided in **Table 4**. Greater detail can be found in the individual program appendices.

In the Baseline projections oil prices are projected to fall from 2004 and then gradually rise through 2025, as shown in **Figure 5**. Natural gas prices are projected to fall more gradually through 2010 and then increase through 2025. Coal prices, on the other hand, are projected to be relatively constant in real terms with a very slight decline. Electricity prices are projected to experience a slight decrease through 2010.

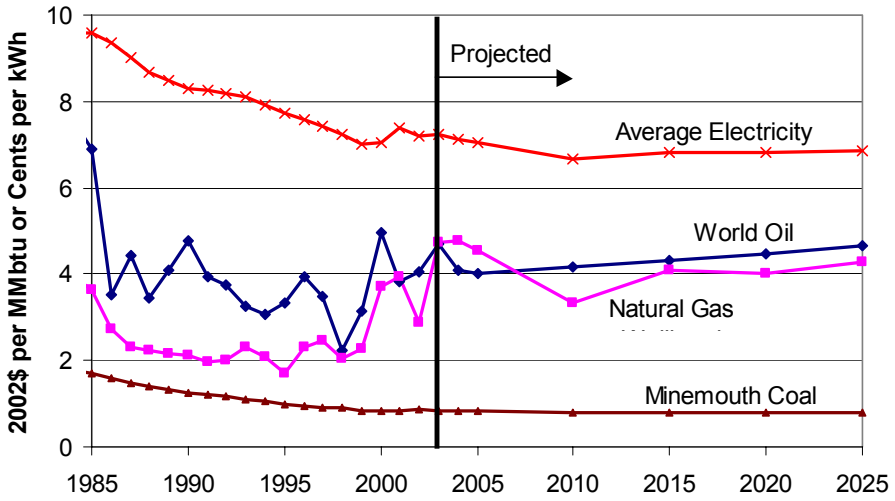

Figure 5. Projected Energy Prices

The resulting Baseline Case projects a 33 percent increase in conventional energy demand from 2005 to 2025[4]. Energy efficiency and renewable energy improvements, however, contribute toward a 25 percent reduction in conventional energy intensity (energy used per dollar of GPD produced) over the same period (Figure 2).[5] Between 2005 and 2025, renewable energy technology improvements result in increases in electric generation in central and distributed applications (in billions of kWh) of 35 for wind, 30 for geothermal, 36 for biomass, 2 for municipal solid waste, 8 for photovoltaics, and 0.4 for solar thermal.

[4] Very similar to the AEO2004.

[5] Energy-intensity changes result from a mix of structural changes in the economy (e.g., growing service sector) and efficiency improvements. Two recent EERE-sponsored studies provide additional background on understanding the sources of changes to our energy intensity: Ortiz and Sollinger, *Shaping Our Future by Reducing Energy Intensity in the U.S. Economy; Volume 1: Proceedings of the Conference* (2003, Rand Corporation) and Bernstein, Fonkych, Loeb, and Loughran, "State-Level Changes in Energy Intensity and their National Implications (2003, Rand Corporation).

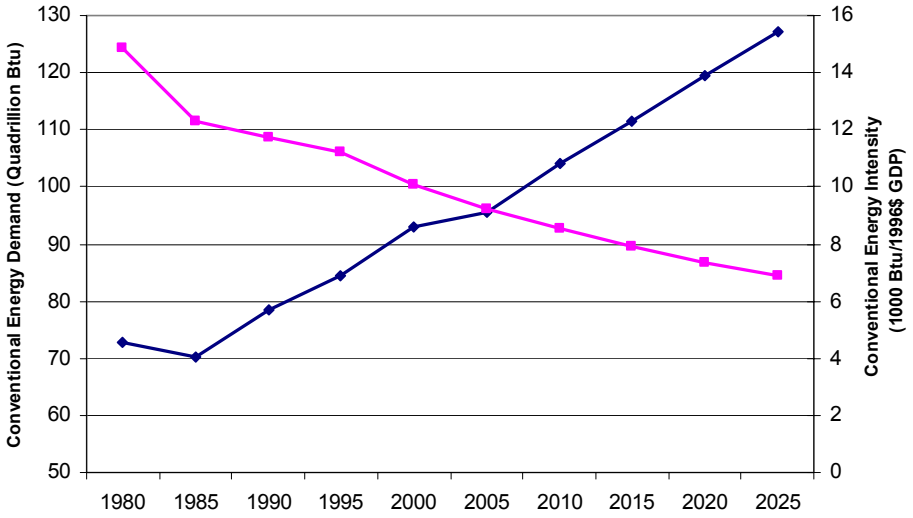

Figure 6. U.S. Conventional Energy Demand and Energy Intensity

EERE NEMS-GPRA06 Baseline Case Tables

Table 1. Total Energy Supply and Disposition Summary
(Quadrillion Btu per Year, Unless Otherwise Noted)

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	2010	2015	2020	2025
Production				
Crude Oil & Lease Condensate	12.60	11.71	10.52	9.81
Natural Gas Plant Liquids	3.18	3.21	3.43	3.46
Dry Natural Gas	21.74	22.23	24.13	24.58
Coal	25.00	26.10	28.13	30.71
Nuclear Power	8.38	8.52	8.57	8.57
Renewable Energy 1/	7.16	7.83	8.34	8.83
Other 2/	0.89	0.79	0.81	0.84
Total	78.94	80.39	83.94	86.80
Imports				
Crude Oil 3/	24.64	29.60	31.49	34.15
Petroleum Products 4/	5.64	6.09	8.21	10.08
Natural Gas	5.71	6.88	7.47	8.18
Other Imports 5/	0.95	1.05	1.12	1.18
Total	36.95	43.63	48.28	53.59
Exports				
Petroleum 6/	2.15	2.17	2.13	2.16
Natural Gas	0.81	0.79	0.80	0.72
Coal	0.89	0.80	0.74	0.55
Total	3.85	3.76	3.67	3.43
Discrepancy 7/	0.32	0.46	0.46	0.54
Consumption				
Petroleum Products 8/	44.29	48.56	51.65	55.41
Natural Gas	26.80	28.51	30.99	32.24
Coal	24.97	26.27	28.47	31.34
Nuclear Power	8.38	8.52	8.57	8.57
Renewable Energy 1/	7.16	7.83	8.34	8.83
Other 9/	0.11	0.11	0.07	0.03
Total	111.72	119.80	128.09	136.42
Net Imports - Petroleum	28.14	33.52	37.56	42.08
Prices (2001 dollars per unit)				
World Oil Price ($ per bbl) 10/	24.17	25.07	26.02	27.00
Gas Wellhead Price($ / Mcf) 11/	3.43	4.20	4.14	4.39
Coal Minemouth Price ($ / ton)	16.69	16.63	16.69	16.56
Aver. Electricity (cents / Kwh)	6.68	6.83	6.82	6.84

1/ Includes grid-connected electricity from conventional hydroelectric; wood and wood waste; landfill gas; municipal solid waste; other biomass; wind; photovoltaic and solar thermal sources; non-electric energy from renewable sources, such as active and passive solar systems, and wood; and both the ethanol and gasoline components of E85, but not the ethanol components of blends less than 85 percent. Excludes electricity imports using renewable sources and nonmarketed renewable energy. See Table A18 for selected nonmarketed residential and commercial renewable energy.

2/ Includes liquid hydrogen, methanol, supplemental natural gas, and some domestic inputs to refineries.

3/ Includes imports of crude oil for the Strategic Petroleum Reserve.

4/ Includes imports of finished petroleum products, imports of unfinished oils, alcohols, ethers, and blending components.

5/ Includes coal, coal coke (net), and electricity (net).

6/ Includes crude oil and petroleum products.

7/ Balancing item. Includes unaccounted for supply, losses, gains, net storage withdrawals, heat loss when natural gas is converted to liquid fuel, and heat loss when coal is converted to liquid fuel.

8/ Includes natural gas plant liquids, crude oil consumed as a fuel, and nonpetroleum-based liquids for blending, such as ethanol.

9/ Includes net electricity imports, methanol, and liquid hydrogen.

10/ Average refiner acquisition cost for imported crude oil.

11/ Represents lower 48 onshore and offshore supplies.

Table 2. Energy Consumption by Sector and Source
(Quadrillion Btu per Year, Unless Otherwise Noted)

Energy Consumption	2010	2015	2020	2025
Residential				
Distillate Fuel	0.92	0.88	0.83	0.79
Kerosene	0.11	0.11	0.10	0.09
Liquefied Petroleum Gas	0.56	0.58	0.61	0.64
Petroleum Subtotal	1.59	1.57	1.55	1.51
Natural Gas	5.71	5.87	6.15	6.32
Coal	0.01	0.01	0.01	0.01
Renewable Energy 1/	0.40	0.40	0.41	0.40
Electricity	4.86	5.19	5.57	5.92
Delivered Energy	12.57	13.05	13.68	14.16
Electricity Related Losses	10.43	10.85	11.34	11.79
Total	23.00	23.89	25.03	25.95
Commercial				
Distillate Fuel	0.63	0.65	0.67	0.69
Residual Fuel	0.13	0.13	0.13	0.13
Kerosene	0.02	0.02	0.02	0.02
Liquefied Petroleum Gas	0.10	0.10	0.10	0.10
Motor Gasoline 2/	0.05	0.05	0.05	0.05
Petroleum Subtotal	0.92	0.95	0.97	0.99
Natural Gas	3.56	3.73	4.01	4.28
Coal	0.10	0.10	0.10	0.10
Renewable Energy 3/	0.10	0.10	0.10	0.10
Electricity	5.02	5.61	6.21	6.78
Delivered Energy	9.70	10.49	11.39	12.24
Electricity Related Losses	10.78	11.71	12.65	13.51
Total	20.47	22.21	24.03	25.75
Industrial 4/				
Distillate Fuel	1.18	1.27	1.34	1.43
Liquefied Petroleum Gas	2.36	2.53	2.74	2.95
Petrochemical Feedstocks	1.35	1.43	1.54	1.63
Residual Fuel	0.21	0.23	0.22	0.23
Motor Gasoline 2/	0.16	0.17	0.18	0.19
Other Petroleum 5/	4.40	4.72	4.96	5.17
Petroleum Subtotal	9.66	10.36	10.98	11.59
Natural Gas 6/	8.62	9.13	9.94	10.76
Lease and Plant Fuel 7/	1.34	1.37	1.51	1.55
Natural Gas Subtotal 6/	9.96	10.50	11.46	12.31
Metallurgical Coal	0.65	0.59	0.53	0.47
Steam Coal	1.43	1.45	1.47	1.48
Net Coal Coke Imports	0.01	0.00	0.00	0.01
Coal Subtotal	2.09	2.04	1.99	1.96
Renewable Energy 8/	2.00	2.26	2.48	2.70
Electricity	3.83	4.16	4.46	4.81
Delivered Energy	27.54	29.32	31.37	33.38
Electricity Related Losses	8.24	8.68	9.08	9.58
Total	35.78	38.00	40.45	42.96

1/ Includes wood used for residential heating. See Table A18 estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal hot water heating, and solar photovoltaic electricity generation.

2/ Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.

3/ Includes commercial sector electricity cogenerated by using wood and wood waste, landfill gas, municipal solid waste, and other biomass. See Table A18 for estimates of nonmarketed renewable energy consumption for solar thermal hot water heating and solar photovoltaic electricity generation.

4/ Fuel consumption includes consumption for combined heat and power, which produces electricity and other useful thermal energy.

5/ Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.

6/ Includes consumption for combined heat and power; excludes consumption by nonutility generators.

7/ Represents natural gas used in the field gathering and processing plant machinery.

8/ Includes consumption of energy from hydroelectric, wood and wood waste, municipal solid waste, and other biomass; includes combined heat and power, both for sale to the grid and for own use.

Table 2. Energy Consumption by Sector and Source (Continued)

	2010	2015	2020	2025
Transportation				
Distillate Fuel 9/	6.43	7.27	8.04	8.94
Jet Fuel 10/	3.93	4.36	4.69	4.91
Motor Gasoline 2/	19.94	21.80	23.37	25.31
Residual Fuel	0.79	0.80	0.82	0.83
Liquefied Petroleum Gas	0.06	0.07	0.08	0.09
Other Petroleum 11/	0.26	0.27	0.30	0.32
Petroleum Subtotal	31.41	34.58	37.30	40.40
Pipeline Fuel Natural Gas	0.72	0.73	0.84	0.87
Compressed Natural Gas 19/	0.06	0.08	0.10	0.12
Renewable Energy (E85) 12/	0.00	0.00	0.00	0.00
Liquid Hydrogen 20/	0.00	0.00	0.00	0.00
Electricity	0.09	0.10	0.11	0.12
Delivered Energy	32.27	35.49	38.35	41.51
Electricity Related Losses	0.19	0.21	0.22	0.24
Total	32.46	35.70	38.58	41.75
Electric Generators 15/				
Distillate Fuel	0.22	0.52	0.30	0.37
Residual Fuel	0.50	0.59	0.55	0.55
Petroleum Subtotal	0.72	1.10	0.85	0.92
Natural Gas	6.80	7.59	8.43	8.34
Steam Coal	22.77	24.12	26.36	29.27
Nuclear Power	8.38	8.52	8.57	8.57
Renewable Energy/Other 16/	4.66	5.07	5.35	5.62
Electricity Imports 17/	0.11	0.11	0.07	0.03
Total	43.43	46.51	49.64	52.74
Total Energy Consumption				
Distillate Fuel	9.37	10.59	11.18	12.22
Kerosene	0.16	0.15	0.14	0.13
Jet Fuel 10/	3.93	4.36	4.69	4.91
Liquefied Petroleum Gas	3.07	3.28	3.54	3.77
Motor Gasoline 2/	20.14	22.02	23.60	25.55
Petrochemical Feedstocks	1.35	1.43	1.54	1.63
Residual Fuel	1.64	1.75	1.72	1.74
Other Petroleum 13/	4.64	4.97	5.23	5.47
Petroleum Subtotal	44.29	48.56	51.65	55.41
Natural Gas	24.74	26.40	28.63	29.81
Lease and Plant Fuel 7/	1.34	1.37	1.51	1.55
Pipeline Natural Gas	0.72	0.73	0.84	0.87
Natural Gas Subtotal	26.80	28.51	30.99	32.24
Metallurgical Coal	0.65	0.59	0.53	0.47
Steam Coal	24.31	25.68	27.94	30.86
Net Coal Coke Imports	0.01	0.00	0.00	0.01
Coal Subtotal	24.97	26.27	28.47	31.34
Nuclear Power	8.38	8.52	8.57	8.57
Renewable Energy 18/	7.16	7.83	8.34	8.83
Electricity Imports 17/	0.11	0.11	0.07	0.03
Total	111.72	119.80	128.09	136.42

2/ Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.
7/ Represents natural gas used in the field gathering and processing plant machinery.
9/ Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur.
10/ Includes only kerosene type.
11/ Includes aviation gas and lubricants.
12/ E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable).
13/ Includes unfinished oils, natural gasoline, motor gasoline blending compounds, aviation gasoline, lubricants, still gas, asphalt, road oil, petroleum coke, and miscellaneous petroleum products.
15/ Includes consumption of energy by electricity-only and combined heat and power (CHP) plants whose primary business is to sellelectricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
16/ Includes conventional hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, petroleum coke, wind, photovoltaic and solar thermal sources. Excludes net electricity imports.
17/ In 1999 approximately 70 percent of the U.S. electricity imports were provided by renewable sources (hydroelectricity); EIA does not project future proportions for the fuel source of imported electricity.
18/ Includes hydroelectric, geothermal, wood and wood waste, municipal solid waste, other biomass, wind, photovoltaic and solar thermal sources. Includes ethanol components of E85; excludes ethanol blends (10 percent or less) in motor gasoline. Excludes net electricity imports and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
19/ Includes natural gas for hydrogen production.
20/ Hydrogen is not reported separately but rather as the fuel feedstock. See note 19.

Table 3. Energy Prices by Sector and Source
(2001 Dollars per Million Btu, Unless Otherwise Noted)

	2010	2015	2020	2025
Residential	14.24	14.92	14.92	15.24
Primary Energy 1/	8.16	8.71	8.62	8.88
Petroleum Products 2/	9.89	10.38	10.88	11.30
Distillate Fuel	7.81	8.04	8.38	8.54
Liquefied Petroleum Gas	13.85	14.46	14.82	15.21
Natural Gas	7.69	8.28	8.07	8.32
Electricity	23.39	23.83	23.62	23.67
Commercial	13.81	14.58	14.73	15.00
Primary Energy 1/	6.49	7.03	6.98	7.22
Petroleum Products 2/	6.33	6.51	6.83	7.00
Distillate Fuel	5.45	5.63	6.00	6.16
Residual Fuel	4.13	4.27	4.41	4.55
Natural Gas 3/	6.66	7.30	7.14	7.40
Electricity	20.51	21.03	21.07	21.15
Industrial 4/	6.47	6.96	7.15	7.39
Primary Energy	5.14	5.62	5.82	6.06
Petroleum Products 2/	6.83	7.11	7.56	7.80
Distillate Fuel	5.68	5.82	6.24	6.41
Liquefied Petroleum Gas	9.67	10.26	10.66	11.11
Residual Fuel	3.74	3.88	4.03	4.17
Natural Gas 5/	4.09	4.82	4.74	5.01
Metallurgical Coal	1.96	1.90	1.84	1.77
Steam Coal	1.57	1.56	1.55	1.52
Electricity	13.52	13.91	13.98	14.07
Transportation	10.52	10.54	10.58	10.75
Primary Energy	10.49	10.51	10.56	10.72
Petroleum Products 2/	10.49	10.51	10.56	10.72
Distillate Fuel 6/	10.16	10.18	10.10	10.14
Jet Fuel 7/	5.76	5.83	6.09	6.32
Motor Gasoline 8/	11.88	11.87	11.91	12.06
Residual Fuel	3.60	3.73	3.87	4.02
Liquefied Petroleum Gas9/	14.92	15.42	15.54	15.86
Natural Gas 10/	8.26	9.04	8.89	9.08
Ethanol (E85) 11/	17.21	17.79	18.58	18.98
Electricity	19.76	20.39	20.06	19.91

1/ Weighted average price includes fuels below as well as coal.
2/ This quantity is the weighted average for all petroleum products, not just those listed below.
3/ Excludes independent power producers.
4/ Includes combined heat and power.
5/ Excludes uses for lease and plant fuel.
6/ Diesel fuel containing 500 parts per million (ppm) or 15 ppm sulfur. Price includes Federal and State taxes while excluding county and local taxes.
7/ Kerosene-type jet fuel. Price includes Federal and State taxes while excluding county and local taxes.
8/ Sales weighted-average price for all grades. Includes Federal, State, and local taxes.
9/ Includes Federal and State taxes while excluding county and local taxes.
10/ Compressed natural gas used as a vehicle fuel. Price includes estimated motor vehicle fuel taxes.
11/ E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable).

Table 3. Energy Prices by Sector and Source (Continued)

	2010	2015	2020	2025
Average End-Use Energy	10.25	10.61	10.70	10.91
Primary Energy	8.23	8.53	8.62	8.84
Electricity	19.58	20.02	20.00	20.06
Electric Generators 12/				
Fossil Fuel Average	1.94	2.16	2.12	2.12
Petroleum Products	4.28	4.57	4.73	4.96
Distillate Fuel	4.94	5.06	5.50	5.68
Residual Fuel	3.99	4.14	4.32	4.48
Natural Gas	4.11	4.80	4.72	4.97
Steam Coal	1.22	1.22	1.21	1.22
Average Price to All Users 13/				
Petroleum Products 2/	9.57	9.65	9.84	10.04
Distillate Fuel	8.93	8.95	9.14	9.24
Jet Fuel	5.76	5.83	6.09	6.32
Liquefied Petroleum Gas	10.61	11.19	11.56	11.97
Motor Gasoline 8/	11.88	11.87	11.91	12.06
Residual Fuel	3.78	3.93	4.08	4.23
Natural Gas	5.30	5.95	5.80	6.06
Coal	1.24	1.24	1.23	1.24
Ethanol (E85) 11/	17.21	17.79	18.58	18.98
Electricity	19.58	20.02	20.00	20.06
Non-Renewable Energy Expenditures by Sector (billion 2001 dollars)				
Residential	173.21	188.68	198.03	209.69
Commercial	132.57	151.57	166.22	182.12
Industrial	133.93	153.11	168.24	185.97
Transportation	331.85	366.20	396.91	436.69
Total Non-Renewable Expenditures	771.56	859.55	929.40	1014.47
Transportation Renewable Expenditures	0.03	0.04	0.05	0.07
Total Expenditures	771.59	859.59	929.46	1014.53

11/ E85 is 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable).

12/ Includes all electric power generators except combined heat and power, which produce electricity and other useful thermal energy. Includes small power producers and exempt wholesale generators.

13/ Weighted averages of end-use fuel prices are derived from the prices shown in each sector and the corresponding sectoral consumption.

Table 4. Electricity Supply, Disposition, Prices, and Emissions
(Billion Kilowatthours, Unless Otherwise Noted)

	2010	2015	2020	2025
Generation by Fuel Type				
Electric Power Sector 1/				
Power Only 2/				
Coal	2170	2313	2581	2934
Petroleum	67	109	79	82
Natural Gas 3/	644	797	922	943
Nuclear Power	803	816	821	821
Pumped Storage/Other	-9	-9	-9	-9
Renewable Sources 4/	400	421	437	452
Distributed Gen (Natural Gas)	1	1	2	7
Non-Utility Gen for Own Use	-37	-37	-37	-37
Total	4039	4411	4796	5192
Combined Heat and Power 5/				
Coal	33	33	33	33
Petroleum	1	5	2	2
Natural Gas	177	163	162	150
Renewable Sources	4	4	4	4
Non-Utility Gen for Own Use	-24	-24	-24	-24
Total	191	181	178	166
Net Available to the Grid	4230	4592	4974	5357
End-Use Sector Generation 6/				
Combined Heat and Power				
Coal	21	21	21	21
Petroleum	12	15	18	18
Natural Gas	108	129	176	235
Other Gaseous Fuels 7/	9	11	12	13
Renewable Sources 4/	39	45	50	54
Other 8/	11	11	11	11
Total	201	233	289	354
Other End-Use Generators 9/	5	5	5	12
Generation for Own Use	-158	-175	-206	-251
Total Sales to the Grid	47	63	88	114
Net Imports	33	31	21	8

1/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.
2/ Includes plants that only produce electricity.
3/ Includes electricity generation from fuel cells.
4/ Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar, and wind power.
5/ Includes combined heat and power plants whose primary business is to sell electricity and heat to the public (i.e., those that report NAICS code 22).
6/ Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors.
7/ Other gaseous fuels include refinery and still gas.
8/ Other includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.
9/ Other end-use generators include small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

Table 4. Electricity Supply, Disposition, Prices, and Emissions (Continued)

	2010	2015	2020	2025
Electricity Sales by Sector				
Residential	1423	1522	1632	1734
Commercial	1470	1644	1820	1986
Industrial	1124	1219	1306	1409
Transportation	26	29	32	35
Total	4043	4414	4790	5165
End-Use Prices 10/ (2001 cents per kilowatthou				
Residential	8.0	8.1	8.1	8.1
Commercial	7.0	7.2	7.2	7.2
Industrial	4.6	4.7	4.8	4.8
Transportation	6.7	7.0	6.8	6.8
All Sectors Average	6.7	6.8	6.8	6.8
Prices by Service Category 10/				
(2001 cents per kilowatthour)				
Generation	4.2	4.4	4.4	4.5
Transmission	0.6	0.7	0.7	0.7
Distribution	1.9	1.8	1.7	1.7
Emissions				
Sulfur Dioxide (million tons)	9.64	9.01	8.95	8.95
Nitrogen Oxide (million tons)	3.47	3.58	3.65	3.72
Mercury (tons)	52.39	53.21	54.18	54.46

10/ Prices represent average revenue per kilowatthour.

Table 5. Electricity Generating Capacity
(Gigawatts)

	2010	2015	2020	2025
Electric Power Sector 2/				
Power Only 3/				
Coal Steam	302.0	316.9	352.9	402.4
Other Fossil Steam 4/	102.1	98.6	97.1	94.9
Combined Cycle	126.2	158.0	177.0	195.5
Combustion Turbine/Diesel	128.0	146.5	160.6	170.5
Nuclear Power 5/	100.6	102.1	102.6	102.6
Pumped Storage	20.3	20.3	20.3	20.3
Fuel Cells	0.1	0.1	0.1	0.1
Renewable Sources 6/	98.2	102.0	104.7	108.0
Distributed Gen (Nat Gas) 7/	1.5	1.9	5.0	15.7
Total	878.9	946.4	1020.4	1110.1
Combined Heat and Power 8/				
Coal Steam	5.2	5.2	5.2	5.2
Other Fossil Steam	1.1	1.1	1.1	1.1
Combined Cycle	32.9	32.9	32.9	32.9
Combustion Turbine/Diesel	5.4	5.4	5.4	5.4
Renewable Sources	0.3	0.3	0.3	0.3
Total	44.9	44.9	44.9	44.9
Total Electric Power Industry	923.8	991.3	1065.2	1154.9
Cumulative Planned Additions 9/				
Coal Steam	1.1	1.1	1.1	1.1
Other Fossil Steam	0.0	0.0	0.0	0.0
Combined Cycle	43.5	43.5	43.5	43.5
Combustion Turbine/Diesel	8.1	8.1	8.1	8.1
Nuclear Power	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0
Fuel Cells	0.1	0.1	0.1	0.1
Renewable Sources	4.3	4.6	4.7	4.8
Distributed Generation	0.0	0.0	0.0	0.0
Total	57.1	57.4	57.5	57.6
Cumulative Unplanned Additions 9/				
Coal Steam	2.5	18.0	55.3	105.9
Other Fossil Steam	0.0	0.0	0.0	0.0
Combined Cycle	6.2	38.1	57.0	75.6
Combustion Turbine/Diesel	8.8	27.9	44.2	55.6
Nuclear Power	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0
Renewable Sources	4.4	7.9	10.5	13.7
Distributed Generation	1.5	1.9	5.0	15.7
Total	23.4	93.7	172.0	266.4
Cumulative Total Additions	80.5	151.1	229.5	324.0
Cumulative Retirements 10/				
Coal Steam	7.4	8.0	9.2	10.4
Other Fossil Steam	28.5	32.0	33.5	35.7
Combined Cycle	1.7	1.7	1.7	1.7
Combustion Turbine/Diesel	10.8	11.4	13.5	15.1
Nuclear Power	0.0	0.0	0.0	0.0
Pumped Storage	0.0	0.0	0.0	0.0
Fuel Cells	0.0	0.0	0.0	0.0
Renewable Sources	0.1	0.1	0.1	0.1
Total	48.5	53.2	58.1	62.9

1/ Net summer capacity is the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power), as demonstrated by tests during summer peak demand.

2/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.

3/ Includes plants that only produce electricity. Includes capacity increases (uprates) at existing units.

4/ Includes oil-, gas-, and dual-fired capacity.

5/ Nuclear capacity reflects operating capacity of existing units, including 4.3 gigawatts of uprates through 2025.

6/ Includes conventional hydroelectric, geothermal, wood, wood waste, municipal solid waste, landfill gas, other biomass, solar and wind power.

7/ Primarily peak-load capacity fueled by natural gas.

8/ Includes combined heat and power plants whose primary business is to sell electricity and heat to the public

Table 5. Electricity Generating Capacity (Continued)

	2010	2015	2020	2025
End-Use Sector Generators 11/				
Combined Heat and Power				
Coal	4.1	4.1	4.1	4.1
Petroleum	1.6	2.0	2.3	2.4
Natural Gas	17.6	20.4	26.8	34.8
Other Gaseous Fuels	2.2	2.4	2.6	2.7
Renewable Sources	5.6	6.7	7.5	8.3
Other	0.3	0.3	0.3	0.3
Total	31.5	35.9	43.7	52.7
Other End-Use Generators 12/	0.0	0.0	0.0	0.0
Renewable Sources	1.4	1.4	1.4	4.8
Cumulative Additions 9/				
Combined Heat and Power	6.0	10.4	18.2	27.2
Other End-Use Generators	0.2	0.2	0.2	3.6

9/ Cumulative additions after December 31, 1999.

11/ Includes combined heat and power plants and electricity-only plants in the commercial and industrial sectors.

12/ Other end-use generators include small on-site generating systems in the residential, commercial, and industrial sectors used primarily for own-use generation, but which may also sell some power to the grid.

Table 6. Carbon Dioxide Emissions by Sector and Source
(Million Metric Tons Carbon Equivalent, Unless Otherwise Noted)

	2010	2015	2020	2025
Residential				
Petroleum	29.9	29.5	28.9	28.1
Natural Gas	82.2	84.5	88.6	91.0
Coal	0.3	0.3	0.3	0.3
Electricity	244.7	258.3	277.2	298.3
Total	357.0	372.6	395.0	417.7
Commercial				
Petroleum	18.1	18.7	19.1	19.5
Natural Gas	51.3	53.7	57.8	61.6
Coal	2.5	2.5	2.5	2.5
Electricity	252.7	279.0	309.0	341.7
Total	324.6	354.0	388.4	425.3
Industrial 1/				
Petroleum	100.1	106.6	111.6	116.8
Natural Gas 2/	141.6	149.2	162.9	175.1
Coal	53.1	51.7	50.6	49.8
Electricity	193.2	206.8	221.8	242.4
Total	487.9	514.5	546.9	584.1
Transportation				
Petroleum 3/	599.5	660.1	712.1	771.5
Natural Gas 4/	11.2	11.8	13.6	14.3
Other 5/	0.0	0.0	0.0	0.0
Electricity	4.5	4.9	5.4	6.1
Total 3/	615.1	676.8	731.2	791.8
Total by Delivered Fuel				
Petroleum 3/	747.6	814.9	871.7	935.9
Natural Gas	286.1	299.2	322.8	341.9
Coal	55.9	54.6	53.4	52.6
Other 5/	0.0	0.0	0.0	0.0
Electricity	695.1	749.1	813.5	888.5
Total 3/	1784.7	1917.8	2061.4	2219.0
Electric Power Sector 6/				
Petroleum	14.9	22.7	17.7	19.0
Natural Gas	97.9	109.3	121.4	120.0
Coal	582.2	617.1	674.5	749.5
Total	695.1	749.1	813.5	888.5
Total by Primary Fuel 7/				
Petroleum 3/	762.5	837.6	889.3	954.9
Natural Gas	384.1	408.6	444.2	462.0
Coal	638.1	671.6	727.9	802.1
Other 5/	0.0	0.0	0.0	0.0
Total 3/	1784.7	1917.8	2061.4	2219.0

1/ Fuel consumption includes energy for combined heat and power plants, except those plants whose primary business is to sell electricity, or electricity and heat, to the public.

2/ Includes lease and plant fuel.

3/ This includes international bunker fuel, which by convention are excluded from the international accounting of carbon dioxide emissions. In the years from 1990 through 1998, international bunker fuels accounted for 25 to 30 million metric tons carbon equivalent of carbon dioxide annually.

4/ Includes pipeline fuel natural gas and compressed natural gas used as vehicle fuel.

5/ Includes methanol.

6/ Includes electricity-only and combined heat and power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Does not include emissions from the nonbiogenic component of municipal solid waste because under international guidelines these are accounted for as waste, not energy.

7/ Emissions from the electric power sector are distributed to the primary fuels.